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METHOD OF APPLYING ANTIBACTERIAL/ANTIFUNGAL AGENT COMPOSITION ON STAINLESS STEEL PROCESSED PORTION OF ELECTRIC WASHING MACHINE

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[Attached amendments have been incorporated into text of translation]

Abstract

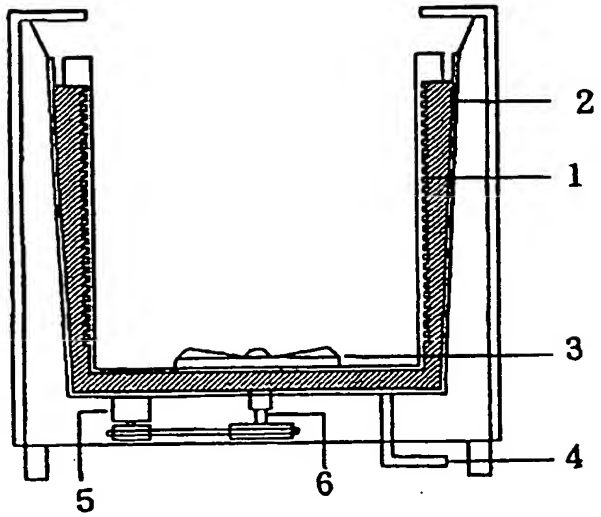
Objective

Recently, fully automatic electric washing machines, of which the washing vessel/dewatering vessel and water-receiving vessel are made of stainless steel, both having high strength and the property of it being difficult for slime composed of soil and microbes to form, have been marketed to the general public. However, the outer wall of the washing vessel/dewatering vessel and inner wall of water-receiving vessel are sites that cannot be cleaned at all. Consequently, a film of slime nourished by metal soaps and various surfactants as well as sebum and protein from the wash clothes is gradually deposited on the surface of the stainless steel. Consequently, an antibacterial/antifungal agent

is doped in the paint for coating these portions to prevent attachment of slime.

Constitution

An antibacterial/antifungal agent is doped in the concentration of 0.01-3.0 wt% in a paint applied by brushing or spaying the outer wall of the washing vessel/dewatering vessel and the inner wall of the water-receiving vessel in the stainless steel processed portion of a fully automatic washing machine, followed by baking so that a strong resin surface is formed with high resistance to scratching. The paints that can be used include water-base paint, oil-base paint, and powder paint.



Claims

1. A processing method of application of an antibacterial/antifungal agent composition to the stainless steel processed portion of an electric washing machine characterized by the following facts: the washing machine is a fully automatic electric washing machine, in which clothes to be washed are loaded together with water in a washing vessel, and soil on fiber products is removed by the water flow generated by using a rotating vane driven by a motor to agitate the wash water prepared by adding a metal soap, synthetic detergent, and other surfactants to the water; in this fully automatic washing machine, the washing vessel/dewatering vessel and water-receiving vessel are made of stainless steel; the outer wall of the washing vessel and the inner wall of the water-receiving vessel, which cannot be cleaned, are coated with an antibacterial/antifungal coating made of a paint doped with an antibacterial/antifungal agent, so as to suppress reproduction of bacteria, fungi, yeast, etc., and to inhibit formation of microbial deposits; as a result, it is possible to prevent microbial contamination of the wash clothes.

2. The processing method of application of an antibacterial/antifungal agent composition to the stainless steel processed portion of the electric washing machine described in Claim 1, characterized by the fact that **2-pyridinethiol-1-oxide zinc salt or a mixture of zinc oxide and 2-pyridinethiol-1-oxide zinc salt in the ratio of 1:1 to 1:20 is doped as the antibacterial/antifungal agent composition in the paint for coating on the stainless steel processed portion.**

3. The processing method of application of an antibacterial/antifungal agent composition to the stainless steel processed portion of the electric washing machine described in Claims 1-2, characterized by the fact that the antibacterial/antifungal agent is carried on calcium carbonate, zinc oxide, ceramics, zeolite, kaolin, talc, bentonite, diatomaceous earth, or other porous inorganic fine powder as a carrier, and the carried antibacterial/antifungal agent is doped in the paint for coating.

4. The processing method of application of an antibacterial/antifungal agent composition to the stainless steel processed portion of the electric washing machine described in Claims 1-3, characterized by the fact that in the fully automatic electric washing machine having a washing vessel/dewatering vessel and water-receiving vessel made of stainless steel, the antibacterial/antifungal paint for coating on the outer wall of the rotating washing vessel/dewatering vessel and the inner wall of the water-receiving vessel is prepared by doping 0.01-3.0% of the antibacterial/antifungal agent composition in an epoxy resin paint, acrylic resin paint, polyester resin paint, polyurethane resin paint, fluoro resin paint, or other water-base paint, oil-base paint, or powder paint.

Detailed explanation of the invention

[0001]

Industrial application field

This invention pertains to a method of formation of an antimicrobial coating layer by applying a paint with an antibacterial/antifungal agent dissolved or dispersed in it on the outer wall of the washing vessel/dewatering vessel (referred to simply as washing vessel hereinafter) and the inner wall of the water-receiving vessel. More specifically, usually, the sites that cannot be reached by the hands of the user are contaminated by bacteria, fungi, yeast, etc., so that a slime deposit is formed. Because the deposit is dislodged by the wash water, the wash water and the wash clothes are contaminated by microbes.

[0002]

Stainless steel has relatively better water draining property and thus less significant contamination by wash water [than other metals]. However, it is difficult to prevent formation of slime on the stainless steel. The metal soap, anionic surfactants, nonionic surfactants, and other detergents as well as the oil-base substances, proteins, and other soils removed from the wash clothes gradually become attached to the stainless steel surface. Then, bacteria, fungi, yeast, and other microbes reproduce there, so that a slime deposit gradually forms. According to this invention, by means of a coating film of a paint doped with an antibacterial/antifungal agent, the growth

and microbial growth are suppressed. As a result, it is possible to prevent contamination of the outer wall of the washing vessel and the inner wall of the water-receiving vessel by microbes, so that the fully automatic electric washing machine can be maintained clean and clothes can be washed with good hygiene.

[0003]

Prior art

In order to meet the residential demand for automated washing for raising the standards of living, fully automatic electric washing machines have been modified to the 2-layer form and have been marketed in large quantity. When the fully automatic electric washing machines were first marketed, thermoplastic resins that can be manufactured in mass quantity were the standard.

[0004]

Soon afterwards, it was found that microbes thrive on the plastic parts of the washing vessel and the water-receiving vessel, becoming unsanitary. As a measure to solve the problem, it was proposed that an antibacterial/antifungal agent be doped in the thermoplastic molding parts that are in direct contact with the wash water in the washing machine. Because a significant antibacterial/antifungal effect was observed, this method was adopted as recommended.

[0005]

Then, a type of fully automatic electric washing machine made of stainless steel, which has a relatively smooth surface and is believed to have relatively less trouble with respect to microbial contamination, began to be used instead of the thermoplastic resin doped with the antibacterial/antifungal agent. This method has been under study by various producers recently. However, although stainless steel has a higher strength than thermoplastic resin, there is yet no particular antibacterial/antifungal treatment for commercially available products.

[0006]

On the other hand, there is concern over possible microbial contamination of washing machines made of stainless steel. The species of microbes commonly found living in washing machines include fungi, such as the genus Penicillium, the genus Aspergillus, the genus Altanallia, the genus Cubrallia, the genus Mucor, etc.; as well as yeasts and many species of bacteria.

[0007]

The method for forming a coating layer with the antibacterial/antifungal agent dispersed in it on the parts of electric washing machines was disclosed in Japanese Kokai Patent Application No. Hei 2[1990]-243194. According to said patent application, the antibacterial/antifungal composition may be dispersed in the thermoplastic resin or in a coating on the

resin. The antibacterial/antifungal compositions that can be used are also described in the patent application. It was pointed out that when the antimicrobial agent is doped in the resin, the heat resistance is the most important condition because the antimicrobial agent must be kneaded at the resin melting point. Usually, however, there are few antibacterial/antifungal agents that can withstand the melting point of the resin. Usually, blending of the antibacterial/antifungal agent in the resin is accompanied by decomposition and discoloration.

[0008]

Problems to be solved by the invention

The fully automatic electric washing machine differs from the 2-vessel-type washing machine having separate washing and dewatering vessels in that the washing vessel also acts as the dewatering vessel, and that it has a water-receiving vessel on the outer side. In the washing vessel, under action of the water flow generated by the rotating vane, the wash clothes are agitated together with the detergent. Dewatering takes place after washing and after rinsing, respectively. The washing vessel and water-receiving vessel used to be made of plastics.

[0009]

This portion is always in contact with the wash water. Even after dewatering, the moisture level is still 100% or higher. Also, plastics have a relatively low strength, and, as they are reinforced, the surface becomes becomes rough with bumps/dips

formed on it for reinforcement. Consequently, simple removal of the metal soap, surfactants, and soil from the wash clothes caught in them is impossible. Also, because plasticizers are added to the plastics, the plastics become softer and are prone to scratches. Consequently, during the use cycle, the parts made of them are scratched and microbes are found thriving in the scratches.

[0010]

As a method to inhibit contamination by microbes, it has been proposed that an antibacterial/antifungal agent, which can withstand the molding temperature of the thermoplastic resin, be blended in the thermoplastic resin. After that, further studies were carried out to improve the materials for making the washing machines. In particular, studies were done on the use of stainless steel, which has excellent water draining property, high resistance to scratching, high strength and allows stamp formation, and washing machines made of stainless steel are commercially available.

[0011]

The parts of the washing machine made of stainless steel are mainly the parts in direct contact with the wash water as needed for washing the wash clothes. In a fully automatic electric washing machine, as one searches for the parts where bacteria, fungi, yeast, and other microbes thrive, caused by the detergent and the soil removed from the wash clothes during washing, one finds that the inner side of the washing vessel is not such a

part because it can be cleaned easily, and, due to rubbing by the wash clothes during washing, there are few microbes that can grow on the inner wall surface of the washing vessel. Also, even when the bacteria, fungi, yeast, and other microbes develop, they can be removed rather easily.

[0012]

On the other hand, the outer wall of the washing vessel and the inner wall of the water-receiving vessel are entirely out of hand reach. Each time the washing machine is used, sebum and protein derived from the soil of the wash clothes, as well as the metal soap and other surfactants and other detergent components may be attached as slime. Consequently, nourished by these components as nutrients, bacteria, fungi, yeast, and other microbes are deposited as slime. After the slime is deposited to a certain degree, it may be dislodged by mechanical shock during washing, and the slime debris becomes dispersed in the wash water or rinse water so that the wash clothes are contaminated. This fact was borne out by the inspection of the microbe count in the wash water. An increase in the microbe count was confirmed.

[0013]

Problems to be solved by the invention

This invention provides a method of formation of an antimicrobial coating made of a paint doped with an antibacterial/antifungal agent applied to the outer wall of the washing vessel and the inner wall of the water-receiving vessel,

which are out of hand reach, so that microbial growth can be suppressed for a long time and the portions inside and outside the washing vessel as well as the wash clothes can be maintained clean at all times.

[0014]

As mentioned above, this invention provides a method of suppression of microbial growth in a fully automatic electric washing machine by forming a coating film of paint doped with an antibacterial/antifungal agent that can suppress growth of bacteria, fungi, yeast, and other microbes on the outer wall of the washing vessel, the inner wall of the water-receiving vessel and other parts made of stainless steel and out of hand reach yet in contact with the wash water during washing.

[0015]

Many types of compounds have been tried for suppressing microbial growth. However, because baking must be performed at 150-300°C for about 1 min to increase the strength of the coating film after applying the paint doped with the aforementioned compounds for suppressing microbial growth so as to increase the strength of the coating film, the compounds should be special compounds that can meet this demand. Few compounds can meet this demand.

[0016]

This invention was reached based on the finding that 2-pyridinethiol-1-oxide zinc salt in its simple form, or a mixture of 1:1 to 1:20 of zinc oxide and [2-pyridinethiol-1-oxide zinc salt] can display improved antibacterial/antifungal effect as well as improved heat resistance for application on the inner wall of the washing vessel and the outer wall of the water-receiving vessel of the electric washing machine of this invention.

[0017]

The aforementioned antibacterial/antifungal agent may be used directly, or carried on calcium carbonate, zinc oxide, ceramics, zeolite, kaolin, talc, bentonite, diatomaceous earth, or other porous inorganic fine powder as a carrier before it is doped in the paint for use.

[0018]

The paints that can be used together with the chemical for suppressing microbial growth to form a coating film include epoxy resin paint, acrylic resin paint, polyester resin paint, polyurethane resin paint, fluororesin paint, etc. When they are heated in baking, the hardness can be increased so that a high resistance to scratching can be displayed. They can form coating films with excellent weatherability, heat resistance, oil resistance, chemical resistance, flexibility, and, in particular,

excellent electric characteristics. It is necessary to select the specific type of paint corresponding to the demand.

[0019]

If the paint is a liquid paint, the paint may be brushed or sprayed, followed by dissipation of the solvent and then heat treatment to increase the strength of the coating film. It is also possible to make use of a powder paint. The types of powder paints that can be used include epoxy-base paints, thermosetting polyester urethane-base paints, thermosetting acrylic-base paints, thermosetting polyester-base paints, etc.

[0020]

Several coating methods may be adopted to coat the powder paint, such as the flow immersion method in which the workpiece is first preheated and then immersed in a container of the powder paint; electrostatic powder spray method, electrostatic flowing immersion method, flame coating method, etc. Several methods may be adopted to blend the antibacterial/antifungal composition in the powder paint, such as the method in which the antibacterial/antifungal composition is first crushed to a fine powder and then blended with the powder paint, and the method in which the antibacterial/antifungal composition and the paint are melted together and then crushed for use.

[0021]

Any paint that can be cured by heating may be used. Baking for forming the coating film should be performed at 150-250°C, or up to about 300°C for about 1 min, and high-quality coating film can be obtained. The coating operation may be performed including one round of coating and one round of baking, or including two rounds of coating and two rounds of baking. The amount of paint applied should be about 50 g/m^2 and the appropriate thickness is 20 ± 5 μm.

[0022]

The amount of the antibacterial/antifungal agent should be in the range of 0.01-5.0%, or preferably in the range of 0.1-3.0%, with respect to a liquid paint, and it should be in the range of 0.1-3.0%, or preferably in the range of 0.05-2.0% with respect to a powder paint. For a water-base paint, the antibacterial/antifungal agent may be dispersed as fine particles in water by means of a surfactant, or the antibacterial/antifungal agent may be dissolved in a solvent followed by adding surfactant. Or, the solution may be added to water for emulsification and dispersion to form a self-emulsified formulation. For an oil-base paint, the antibacterial/antifungal agent may be added directly. The antibacterial/antifungal agent may be used together with effect-enhancing agents, UV inhibitor, oxidation inhibitor, and other antibacterial/antifungal agents. It may be used together with a coloring agent.

[0023]

Function

According to this invention, the antibacterial/antifungal agent is doped in an acrylic resin paint, or an epoxy resin that cures at room temperature, or an epoxy resin that cures under baking, or other paint, and the doped paint is then applied to the stainless steel parts of a fully automatic electric washing machine which are in contact with the wash water, in particular, the outer wall of the washing vessel and dewatering vessel and the inner wall of the water-receiving vessel, which used to be prone to attachment of contaminated water. After coating of the paint doped with the antibacterial/antifungal agent on the stainless steel parts, baking is performed to form a coating layer, so that growth of bacteria, fungi, yeast, and other microbes can be prevented in this method.

[0024]

The substances that are eluted into the wash water during washing include human sebum, protein, and other soil removed from clothes, as well as synthetic detergent, metal soap, and various other surfactants used for washing. As the washing operation is carried out repeatedly, the soil contained in the wash water and rinse water gradually becomes attached to parts of the washing machine. On one hand, the inner wall of the washing vessel which is in contact with the wash water and rinse water and made of stainless steel is smooth, and can be cleaned by friction with the wash clothes. Also, the dirt attached to the corners of the

inner wall of the washing vessel can also be removed easily by hand cleaning, so that the bacteria, fungi, yeast, and other microbes cannot become attached there.

[0025]

On the other hand, for the outer wall of the washing vessel, the inner wall of the water-receiving vessel, and other sites out of hand reach, bacteria, fungi, yeast, and other microbes grow, and slime is gradually deposited on them. Said deposit usually cannot be removed by conventional home use. Consequently, each time clothes are washed, they are contaminated by the microbes.

[0026]

This invention provides a method that can get rid of the contamination by bacteria, fungi, yeast, and other microbes and keep the wash clothes always in a clean state even for the outer wall of the washing vessel, the inner wall of the water-receiving vessel, and other parts of the fully automatic electric washing machine which are in contact with the wash water, by applying a coating layer from a paint doped with an antibacterial/antifungal agent. In the following, this invention will be explained in more detail with reference to an application example. However, this invention is not limited to this application example.

[0027]

Application example

[0028]

Application Example 1

Figure 1 is a cross-sectional view of the fully automatic electric washing machine of this invention. In this figure, (1) represents a rotary washing vessel/dewatering vessel; (2) represents a water-receiving vessel. Both of them are made of stainless steel. According to this invention, the outer wall of the washing vessel/dewatering vessel and the inner wall of the water-receiving vessel are coated with a paint doped with an antibacterial/antifungal agent. Usually, for the hatched portions shown in the figure, since they are out of hand reach for cleaning, slime would develop due to bacteria, fungi, yeast, and other microbes. Because it is impossible to remove them, slime composed of bacteria, fungi, yeast, and other microbes is gradually deposited.

[0029]

In this invention, as a method to suppress microbial growth in the hatched portions that cannot be cleaned and which conventionally have the most serious microbial growth, microbial growth is inhibited at the part surrounded by the outer wall of the rotary washing vessel/dewatering vessel and the inner wall of the water-receiving vessel as represented by (1) and (2). (3)

represents a rotating vane for inducing a water flow. (4) represents a water exhaust pipe made of rubber or resin doped with an antibacterial/antifungal agent to prevent microbial growth on the inner surface. (5) represents a motor which rotates the rotary washing vessel/dewatering vessel. (6) represents the bearings of the rotating vane.

[0030]

Tables I-IV list the results of the tests performed for two types of antibacterial/antifungal paints for application the stainless steel parts: antibacterial/antifungal agent prepared from 2-pyridinethiol-1-oxide zinc salt mixed with calcium carbonate without antibacterial/antifungal ability and used as an excipient, and antibacterial/antifungal agent prepared from 2-pyridinethiol-1-oxide zinc salt mixed with zinc oxide. It can be seen that the effect of the latter is better than the former. Consequently, it was decided that all subsequent tests would be performed using a mixture of [2-pyridinethiol-1-oxide zinc salt] and zinc oxide. The coating method and the antibacterial/antifungal property test were performed as follows.

Chemicals used:

No. 1: A composition of 20% of 2-pyridinethiol-1-oxide zinc salt and 80% of zinc oxide

No. 2: A composition of 20% of 2-pyridinethiol-1-oxide zinc salt and 80% of calcium carbonate

Amount of chemicals added:

With respect to the solids content of the paint 1.0, 3.0, 5.0, 10.0%, and no addition for both Nos. 1 and 2

Type of paint used: Polyester paint (product of Dai-Nippon Paint Co., Ltd.)

Paint preparation method: The chemicals for use were crushed to particle size 20 μm or smaller, and the particles were added to the paint. After stirring well for uniform dispersion, the mixture was coated on the stainless steel, followed by baking.

Stainless steel sheet used: SUS 304 with thickness of 0.6 mm

[0031]

Coating conditions:

Solids content of paint: 45%

Coating constitution: 2 rounds of coating, 2 rounds of baking

Thickness of coating: 5 μm for the first round, and 18 μm for the second round

Baking temperature: 280°C

Baking time: 60 sec

[0032]

The test on the antibacterial/antifungal property of the stainless steel coated with the aforementioned paints doped with the antibacterial/antifungal agent was carried out under the following conditions. The test method is as follows.

Antibacterial test method: JIS L 1902 Halo method.

Species of bacteria used in the test:

Staphylococcus aureus ATCC 6538P

Escherchia coli O-16

Antifungal test: According to JIS S 2911.

Species of fungi used in the test:

Penicilium citrinum FERM S-5

Aspergillus niger FERM S-1

Table I lists the results of the antibacterial test performed using compound No. 1, and Table III lists the results of the antifungal test using it. Figure II lists the results of the antibacterial test using compound No. 2, and Table IV lists the results of the antifungal test using it.

[0033]

Table I

(1) 薬剤添加量	1．0％	3．0％	5．0％	10．0％
s.aureus	ハローあり	ハローあり	ハローあり	ハローあり (3)
E.coli	ハローあり	ハローあり	ハローあり	ハローあり
(2) 無添加	ハローなし	ハローなし	ハローなし	ハローなし (4)

Key: 1 Dose of the compound added
2 Not added
3 Halo present
4 No halo

[0034]

Table II

① 薬剤添加量	1．0％	3．0％	5．0％	10．0％
s.aureus	ハローあり	ハローあり	ハローあり	ハローあり
E.coli	ハローなし	ハローあり	ハローあり	ハローあり
② 無添加	ハローなし	ハローなし	ハローなし	ハローなし

③ ④

Key 1 Dose of the compound added
2 Not added
3 Halo present
4 No halo

[0035]

Table III

① 薬剤添加量	1．0％	3．0％	5．0％	10．0％
P.citrinum	3－3	3－3	3－5	3－7
A.niger	3－1	3－2	3－2	3－3
② 無添加	1	1	1	1

Key: 1 Dose of the compound added
2 Not added

[0036]

Table IV

① 薬剤添加量	1．0%	3．0%	5．0%	10．0%
P.citrinum	3－0	3－1	3－2	3－2
A.niger	2－0	3－0	3－0	3－1
② 無添加	1	1	1	1

Key: 1 Dose of the compound added
2 Not added

The grades listed in the aforementioned tables for the antifungal test refer to the definitions for grading the results of the antifungal test listed in Table V.

[0037]

Table V lists the method of evaluation by the antifungal test.

Table V

3	試料上に接種したカビの発育が認められない。
2	試料上に接種したカビの発育面積が試料の１／３を超えない。
1	試料上に接種したカビの発育面積が試料の１／３を超える。

Key: 3 No growth of fungi seeded on the specimen is observed.
2 The area of growth of fungi seeded on the specimen is smaller than 1/3 of the area of the specimen.
1 The area of growth of the fungi seeded on the specimen is larger than 1/3 of the area of the specimen.

(Note) In the method of representation of the fungal resistance test (JIS Z 2911), if there is also a zone of inhibition in addition to grade 3, the size of the zone of inhibition (mm) is shown on the right side.

[0038]

Method of representation of antibacterial test evaluation

As a method of evaluating the antibacterial property using the halo method, it is designated as effective if there is a halo, while it is designated as ineffective if there is no halo.

[0039]

After a coating layer was formed from a paint doped with an antibacterial/antifungal agent on the stainless steel sheet, a test for the coating surface of the specimen was performed on the antibacterial/antifungal property after running under severe conditions.

Test method

The time for each round of washing was 45 min. When washing is performed once every day, the total washing time in 365 days (1 year) becomes about 685 h [sic]. Consequently, in the test, the stainless steel sheet after coating was set in flowing water for 57 h (corresponding to about 1 month), 171 h (corresponding to about 3 months), 342 h (corresponding to about 6 months), 685 h (corresponding to about 1 year), 2055 h (corresponding to about 3 years), 3425 h (corresponding to about 5 years), respectively. In each round of washing, the amount of water was about 135 L, and the washing time was 45 min. Consequently, processing was performed in flowing water at a rate of 5 L/min. Tables VI and VII list the results of the antibacterial test performed after operating under severe conditions. Tables VIII and IX list the results of the test of the antifungal property.

[0040]

Table VI
Compound No. 1

菌　種	過酷条件	1.0%	3.0%	5.0%	10.0%
s. aureus	1ヶ月相当	ハロー有り	ハロー有り	ハロー有り	ハロー有り
	3ヶ月 〃	ハロー有り	ハロー有り	ハロー有り	ハロー有り
	6ヶ月 〃	ハロー有り	ハロー有り	ハロー有り	ハロー有り
	1ヶ年 〃	ハロー有り	ハロー有り	ハロー有り	ハロー有り
	3ヶ年 〃	ハロー無し	ハロー有り	ハロー有り	ハロー有り
	5ヶ年 〃	ハロー無し	ハロー有り	ハロー有り	ハロー有り
	無添加	ハロー無し	ハロー無し	ハロー無し	ハロー無し

Key: 1 Species of bacteria
2 Severe conditions
3 Corresponding to _ month
4 Corresponding to _ year
5 Not added
6 Halo present
7 No halo

[0041]

Table VII

Compound No. 1

(1) 菌　種	過酷条件 (2)	1.0%	3.0%	5.0%	10.0%
E.coli	(3) 1ケ月相当	ハロ-あり	ハロ-あり	ハロ-あり	ハロ-あり
	(3) 3ケ月 〃	ハロ-あり	ハロ-あり	ハロ-あり	ハロ-あり
	(3) 6ケ月 〃	ハロ-あり	ハロ-あり	ハロ-あり	ハロ-あり
	(4) 1ケ年 〃	ハロ-あり	ハロ-あり	ハロ-あり	ハロ-あり
	(4) 3ケ年 〃	ハロ-なし	ハロ-あり	ハロ-あり	ハロ-あり
	(4) 5ケ年 〃	ハロ-なし	ハロ-なし	ハロ-なし	ハロ-あり
	(5) 無添加	ハロ-なし	ハロ-なし	ハロ-なし	ハロ-なし

(6) Halo present

(7) No halo

Key: 1 Species of bacteria
2 Severe conditions
3 Corresponding to _ month
4 Corresponding to _ year
5 Not added
6 Halo present
7 No halo

[0042]

Table VIII

Compound No. 1

(1) 菌　種	(2) 過酷条件	1.0%	3.0%	5.0%	10.0%
P.citrinum	(3) 1ケ月相当	3－2	3－3	3－4	3－4
	(3) 3ケ月 〃	3－1	3－3	3－3	3－4
	(3) 6ケ月 〃	3－1	3－1	3－2	3－3
	1ケ年(4)	3－0	3－1	3－2	3－3
	(4) 3ケ年 〃	3－0	3－0	3－0	3－1
	(4) 5ケ年 〃	2	3－0	3－0	3－1
	(5) 無添加	1	1	1	1

Key: 1 Species of bacteria
2 Severe conditions
3 Corresponding to _ month
4 Corresponding to _ year
5 Not added

[0043]

Table IX
Compound No. 1

(1) 菌　種	過酷条件 (2)	1.0%	3.0%	5.0%	10.0%
A.niger	(3) 1ケ月相当	3－1	3－2	3－2	3－2
	(3) 3ケ月 〃	3－1	3－2	3－1	3－2
	(3) 6ケ月 〃	3－0	3－0	3－1	3－1
	(4) 1ケ年 〃	3－0	3－0	3－1	3－0
	(4) 3ケ年 〃	2	3－0	3－0	3－0
	(4) 5ケ年 〃	2	2	3－0	3－0
	(5) 無添加	1	1	1	1

Key: 1 Species of bacteria
2 Severe conditions
3 Corresponding to _ month
4 Corresponding to _ year
5 Not added

[0044]

Effect of the invention

Instead of the thermoplastic resins used in the conventional method, stainless steel has been adopted in manufacturing the

washing vessel/dewatering vessel and water-receiving vessel of the fully automatic electric washing machine. Stainless steel has a smooth surface and is believed to have less microbial contamination. However, the metal soap, nonionic surfactant, and other detergent components and soil removed from the wash clothes are attached on the outer wall of the washing vessel and the inner wall of the water-receiving vessel. Because the sites where the deposit is attached are out of hand reach, it is not an easy job to remove the deposit. According to this invention, by applying a coating layer of a paint doped with an antibacterial/antifungal agent, it is possible to suppress microbial growth and to minimize contamination by microbes in water, so that the wash clothes can always be kept clean.

Brief description of the figure

Figure 1 is a longitudinal cross-sectional view illustrating the main parts in the structure of the electric washing machine used in the application example of this invention.

Explanation of reference numbers

1 Washing vessel/dewatering vessel (made of stainless steel)
2 Water-receiving vessel (made of stainless steel)
3 Stirring vane
4 Water exhaust pipe
5 Motor
6 Bearing of the stirring vane

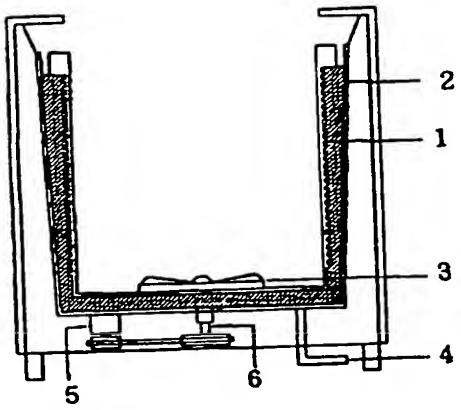


Figure 1